This second independent location of En originated in the En stock which has been propagated since 1952.

2. $a_1$ mutable

In previous Maize News Letters (1953, 1956) it was reported that a new $a_1$ mutable ($a_1^m$) appeared in a culture of mutable pale green ($pg^m$). This mutable allele mutates from $a_1$ to $A_1$ (colorless to full color) and is characterized in the kernel by dots of dark anthocyanin pigment on a non-pigmented colorless background.

At least seven distinct patterns are recognizable: these range from kernels with a small dot pattern to other kernels with large areas of anthocyanin pigmentation. These patterns depend on the frequency and time of mutation events. Individual patterns are heritable as definite properties of the individual $a_1^m$ allele and are not a result of segregating modifiers. This is evident from the results of continued outcrosses. In each case the parental pattern is recovered in all of the progeny except a few (± 1%) which possess new patterns that are in turn distinct and heritable. Such results indicate that control of the pattern is intrinsic to the mutable allele itself. Outcross tests show also that the control of mutability resides at the $a_1$ locus indicating that mutability is autonomously controlled.

Mutation to the colorless stable form: the most conspicuous change in the different patterns of $a_1^m$ is the change to a stable, non-pigmented form, $a_1^s$. The rate of change to $a_1^s$ varies in frequency, but in general the earlier occurring patterns mutate to $a_1^s$ at a higher rate (± 6%) in testcrosses than do the finer dot-like patterns (1-2%). Thus, the different patterns can also be identified by their rate of mutability to the stable form.

A separable mutator: In several testcrosses ($a^m$Sh/$a^{dt}$sh x $a^{dt}$sh/$a^{dt}$sh) of an $a^m$ allele with a fine mutable pattern, half of the non-shrunken kernels were stable and half were mutable. The shrunken kernels were completely colorless. Such a result indicates that a mutator is segregating and when present causes the $a_1^m$ allele to mutate. Half of the shrunken kernels should therefore contain the factor. Crosses were made between plants of stables and numerous sib shrunken kernels. In half of the crosses, half of the non-shrunken kernels on the ear were mutable. This verifies the presence of a separable factor controlling mutability. This independent controller of mutability arose from the autonomous type. The recovery of this independent controller of mutability is similar to the recovery of independent En in pg stocks containing the autonomous type of mutability control.

The colorless kernels that become mutable in the presence of the above described controller of mutability are unaffected by Dt or Ac. Similarly, $a^{dt}$ and Ds-controlled loci do not mutate in the presence of this independent mutator. Crosses are now in progress to determine whether this independent mutator will cause $pg^s$ to become mutable.

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3. Studies of the mutable system at the viviparous-2 locus.

There are three alleles known at the vp-2 locus on chromosome five, vp-2, $w^{alb}$-4889 and green mosaic. They all are characterized by pale yellow or white seeds that often are smaller than normal and frequently have a tendency to germinate prematurely producing albino seedlings. In addition to these traits the green mosaic allele shows frequent back mutation to normal in both the endosperm and seedling, resulting in a pale yellow endosperm with patches of yellow and in white seedlings with a mosaic of green tissue.

For the past couple of years an intensive study of the mutable green mosaic allele has been made. As mentioned in last year's News Letter five levels of mutability have been recognized (very strong, strong, light, light minus, and weak); in addition several stable white lines have been isolated. In all cases these stable white lines have been derived from ears that were segregating for weak mosaic or white as well as other mutable types. As a general rule it does not appear that lines segregating for only stable white seedlings can be derived from very strong or strong mosaic stocks in one step. An ear must first occur that is segregating one of the lower levels of mutability in addition to very strong or strong mosaic. From such an ear it is then possible in future generations to isolate stable white lines.

Additional intercrosses between stocks of the various levels of mutability have been made. The results are in agreement with the pattern of interaction reported last year. Crosses of very strong, strong, light mosaic and light minus mosaic to stable white lines result in seedlings that have lower levels of mutability than the mosaic parent. Usually the level of mutability is at least one class lighter. Similar crosses to the vp-2 and the $w^{alb}$-4889 alleles give the same results as crosses to stable white. Crosses between very strong and light, very strong and weak, and strong and light all have lower levels of mutability than the parent with the highest level.

By selfing it has been possible to establish lines at each of the various levels of mutability that consistently, although not invariably, give ears with only one class of mosaic seedlings. When such lines are outcrossed and the outcrosses selfed, three classes of segregating ears are produced: 1) those which segregate only mutant seedlings with the original level mutability, 2) those segregating both seedlings with the original level and some with the lower levels of mutability and 3) those segregating only seedlings with levels of mutability lower than the original parent. Of 105 such outcrosses tested this year the frequencies of the three classes were 26, 52, and 27 respectively.